Temperature-induced stochastic resonance in time-modulated Kerr non-linear photonic cavities

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Abstract

Driven photonic cavities are widely studied because they show a lot of interesting effects going from non-reciprocity[1] to cooling[2]. Moreover, adding noise in a modulated non-linear system can lead to stochastic resonance[3] which corresponds to periodic transitions between stable states. This can, for example, enhance energy harvesting[4]. In this work, we study coherent and incoherent outgoing power from a non-linear driven photonic cavity coupled to an external port. Using a Langevin framework and temporal modulation, we show that the system temperature induces stochastic resonance in the bistable regime. We explore extensively different cases depending on the system temperature, loss rates and modulation frequency. We demonstrate that such a system exhibits frequency conversion, maximized at the stochastic resonance. Finally, we also suggest a semi-analytical method for the estimation of the coherent outgoing power in this regime.

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